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Presence of pesticide residue in feeds – An assessment

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Introduction

The presence of varying types of toxic substances in feed is undesirable as it acts as the main source of entry of these chemicals into the animal body, redistribution and deposition in different tissues for a long time depending on the nature of the toxicants. Feed safety is equally important as food safety as both are directly linked when production of food of animal origin is concerned. Presence of pesticide residues are often reported in different feed resources (Kang *et al*., 2002; Sharma *et al*., 2005; Nag, 2006). These residues may ultimately contaminate the food chain and accumulate in human body. The present study deals with the extent and level of contamination in commonly used feed of different places with residues of few organophosphates (OP) and synthetic pyrethroid (SP) pesticides and assessment of the risks associated with it.

Material and methods

We targeted 10 popular and mostly used OPs (Dichlorvos, Phorate, Dimethoate, Monocrotophos, Phosphamidon, Methyl parathion, Chlorpyphos, Malathion, Quinalphos, Triazophos) and seven SPs (Fenpropathrin, Cyhalothrin, Cyfluthrin, Cypermethrin, Fenvalerate, Fluvalinate and Deltamethrin) for residue analysis.

Sampling: Concentrate feed and straws commonly used for feeding the milk and meat animals like oilseed cakes of mustard, linseed, Sesamum, Cotton, pulse byproducts *i.e*. chunnies (Powdered outer seed coat), cereal byproducts (chunnies of oat, rice, wheat flour) and pashu ahar (commercial concentrate mixture) were collected from places like Jhansi, Gwalior, Kanpur and Lucknow during 2007-2009. Random sampling procedure was followed and after collection samples were brought to the laboratory and kept in deep freezer at -20^{0}C until analyzed. Extraction and cleanup-Methods given by Luke *et al*., (1975) and Nakamura *et al*., (1994) with modification were followed.

Analysis: The qualitative and quantitative determination was done in Gas Chromatography (GC) of Varian make and CP 3800 model fitted with Ni^{63} electron capture detector (ECD) and thermionic specific detector (TSD). The GC operating conditions were as follows:

For SPs: Detector – ECD; Column- Capillary, CP-Sil 5CB (30m×0.32mm id×0.25µ); Column temp. 250^{0}C for 1 min then @ 5^{0}C/min to 280^{0}C for 10 min; Injection port temperature-280^{0}C (split1:10), Detector-300^{0}C; Carrier gas - N_2 @ of 1 ml/min.

For OPs: Detector – TSD; Column- Equity 5 fused silica capillary (30m×0.32mm id×0.25µ); Column temp. 160^{0}C for 1 min then @ 3^{0}C/min to 190^{0}C for 0 min then @ 10^{0}C/min to 240^{0}C for 5 min; Injection port temperature-250^{0}C, Detector-300^{0}C. Carrier gas - N_2 @ 1 ml/min; Detector gas- H_2 @ 1 ml/min and air @ 175 ml/min.

Result and Discussion

Out of a total 253 feed samples collected from the four places, 85 (33.6%) samples contained OP residues. Different OP pesticides detected and their concentration range is depicted in Table-1. About 29% samples from Jhansi were positive with residues of all the targeted OPs excepting monocrotophos and phosphamidon. The level of contamination in Kanpur samples were lesser as only 12 out of 47 (25.53%) were positive and only five out of 10 targeted OPs were detected. But 40% samples from both Gwalior and Lucknow were contaminated and seven and six targeted OPs were detected in those samples respectively. So samples of Gwalior and Lucknow contained OP residues to a higher extent followed by Jhansi and Kanpur. Presence of OP residues in feed were not much reported in earlier studies as those studies mainly focused on organochlorinated pesticides. Only in few instances presence of OP residues in feed samples was recorded. Kang *et al*., (2002) detected malathion in a limited number of samples of feed concentrate from Ludhiana while Sharma *et al*., (2005) found presence of a number of OP pesticides *viz*., chlorpyriphos, phorate, monocrotophos, dimethoate and diazation in feed concentrate samples collected from Karnal, Haryana. However as a part of a very comprehensive work on monitoring of pesticide residues in animal feed samples collected from Bundelkhand region, Nag (2006) could detect residues of nine

OP pesticides, mainly identified compounds being chlorpyriphos, quinalphos, malathion and phosphamidon but concentration of OPs in positive samples was very less. In the present investigation residues of mainly four OPs *viz*., chlorpyriphos, malathion, quinalphos and dichlovos were detected more frequently than the others. The concentration of different OPs in positive samples varied from 0.009 – 0.489 mg/kg which may be considered as safe so far as their chance of passage to milk is concerned.

The extent of contamination of feeds with SPs was comparatively less than the OPs. Out of 253 samples SPs were recorded in 50 (19.76%) only. Samples from Jhansi were almost free from SP residues as only seven out of 83 (7.23%) were positive. In samples of rest of the places contamination level varied from 25-27%. Fenpropathrin, cyhalothrin, and cypermethrin were the main SPs recorded in positive samples. Different SP pesticides detected and their concentration range is depicted in Table 2.

Report on presence of SP residues in feed was still rarer than the OPs. The main reason for this may be that SPs were not included as part of the monitoring programme and also due to the fact of very less use of costly SPs compared to other group of pesticides. Nag (2006) reported residues of SPs in about 50% feed samples of Bundelkhand and observed that cypermethrin was the main SP present in all types of feed samples of most of the sampling points. In the present investigation, like OPs, concentrations of SPs in positive samples were very meager (003-0.238 mg/kg) which is most unlikely to cause any concern on food safety. As there is no safe or maximum permissible limit available for pesticides in feed/fodder recommended by PFA or FSSAI (FSSR, 2011) the data on residue concentrations of different OP and SP pesticides could not be compared.

Table 1: Organo phosphorus pesticide residue in feed sample

Place	**Total sample**	**Contaminated sample**	**Detected pesticides and their concentrations (mg/kg)**
Jhansi	83	24 (28.91%)	Dichlorvos (0.02-0.095), Phorate (0.012-0.163), Dimethoate (0.015-0.203), Methyl-parathion (0.012), Malathion (0.011-0.032), Chlorpyriphos (0.01-0.246), Quinalphos (0.012-0.184), Triazophos (0.301)
Gwalior	75	30 (40.00%)	Dichlorvos (0.015-0.031), Methyl-parathion (0.013-0.053), Malathion (0.011-0.056) Chlopyriphos (0.009-0.063), Quinalphos (0.009-0.074), Triazophos (0.072)
Kanpur	47	12 (25.53%)	Dimethoate (0.036-0.069), Methyl-parathion (0.014-0.489), Malathion (0.02-0.025), Chlorpyriphos (0.02-0.266), Triazophos (0.051-0.289)
Lucknow	48	19 (39.58%)	Dichlorvos (0.013-0.177), Dimethoate (0.033-0.046), Methyl-parathion (0.018-0.128), Malathion (0.015-0.148), Chlorpyriphos (0.01-0.018), Quinalphos (0.012-0.015), Triazophos (0.106-0.118)
Total sample = 253		85 (33.6%)	

Table 2: Synthetic pyrethroid residue in feed sample

Place	**Total sample**	**Contaminated sample**	**Detected pesticides and their concentrations (mg/kg)**
Jhansi	83	6 (7.23%)	Fenpropathrin (0.006), Cyhalothrin (0.003), Fenvalerate (0.024)
Gwalior	75	19 (25.33%)	Fenpropathrin (0.008-0.016), Cyhalothrin (0.003-0.005), Cypermethrin (0.019-0.337), Fenvalerate (0.011-0.056), Fluvalinate (0.007-0.013)
Kanpur	47	12 (25.53%)	Fenpropathrin (0.013-0.067), Cyhalothrin (0.005-0.009), Cypermethrin (0.082), Fenvalerate (0.013-0.074)
Lucknow	48	13 (27.08%)	Fenpropathrin (0.007-0.043), Cyhalothrin (0.006-0.012), Cypermethrin (0.028-0.133), Fenvalerate (0.016-0.238)
Total sample = 253		50 (19.76%)	

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